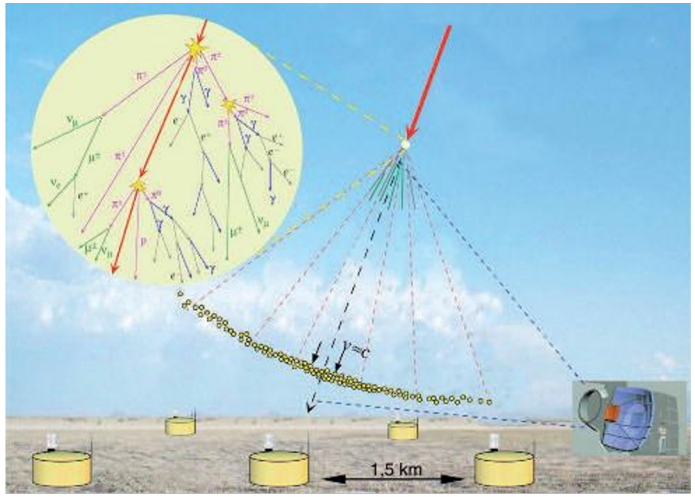
EEE PROJECT 22/23

Liceo Scientifico «G. Galilei», Lanciano

DATA ANALYSIS RELATED TO THE ABSORPTION OF COSMIC RAYS IN THE MATTER: ROSSI'S CURVE



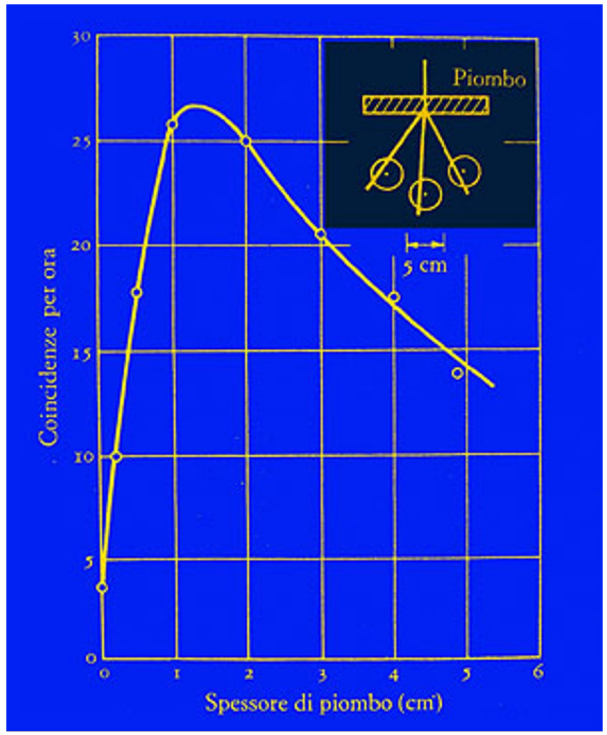
Cosmic rays' particles that pass through dense matter progressively lose energy.

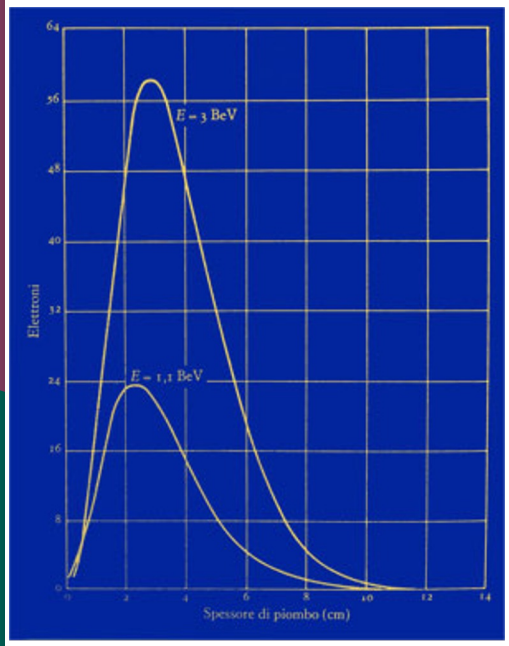
Each material behaves differently in relation to cosmic radiation. Intuitively, we would expect that cosmic rays are absorbed progressively as the thickness of matter increases.

Practically, however, it happens that swarms of particles are produced inside the matter, the number of particles increases until the **thickness** is large enough to absorb the same particles produced.

With a similar experiment, Rossi produced the **curve of swarms**, better known today as **"Rossi's curve"**, which describes the behavior of swarms of particles as the thickness of the material they pass through varies.

Intuitively we would expect that as the thickness of matter increases, cosmic rays are progressively absorbed. In practice, however, it happens that swarms of particles are produced inside the matter, the number of particles increases until the thickness is large enough to absorb the same particles produced, at this point **the measured flow begins to progressively decrease**.



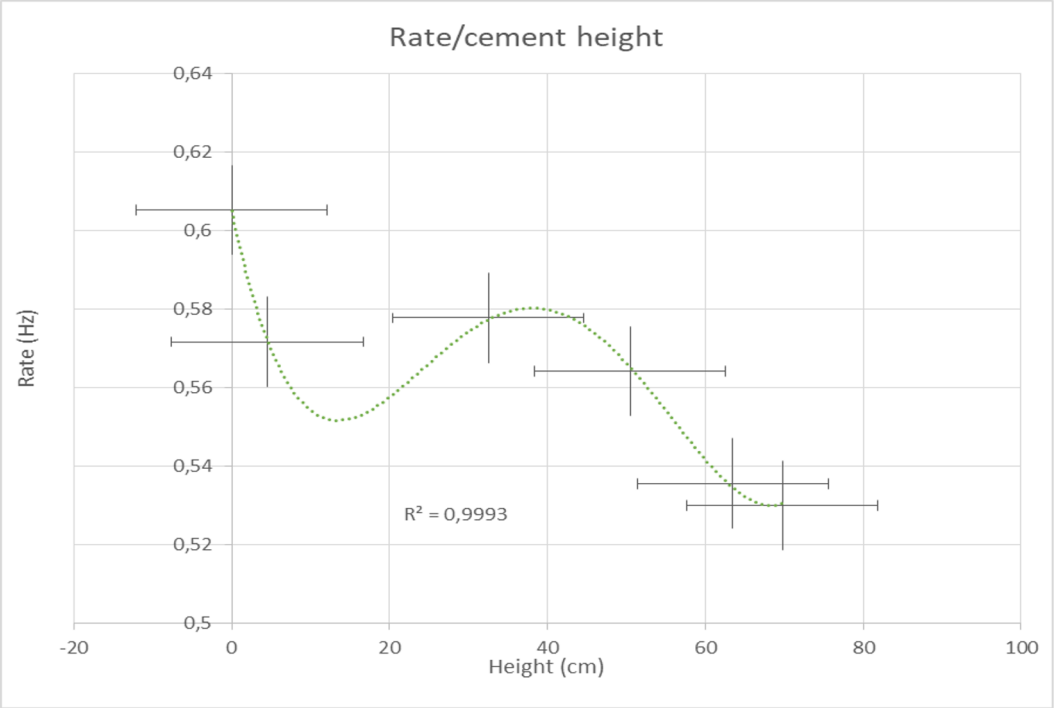


Rossi's experiments showed that **the greater the density** of the material crossed, **the greater the production** of particles, as well as the greater the re-absorption of the same swarms produced.

The process can be simplified as follows: a cosmic ray, for example a **muon**, crossing the metal, interacts with the electric field of the atoms and produces radiation (**photons**). The photons produced if they have enough energy can produce a pair of particles: electron + positron. These particles can in turn produce radiation (more photons) and the mechanism continues as long as the energy is sufficient; when the energy is lower than that of the sum of electron + positron (about 1MeV) the radiation is absorbed in other processes, for example by **ionization**.

MEASURES - 25/02/2023

Time(s)	Height(cm)	Rate(Hz)	Count	Error
2700	0	0,605	1634	0,00061
600	4,5	0,571	343	0,00291
2700	32,5	0,578	1560	0,00064
1200	50,5	0,564	677	0,00148
2700	63,5	0,535	1446	0,00069
2700	69,8	0,530	1431	0,0007



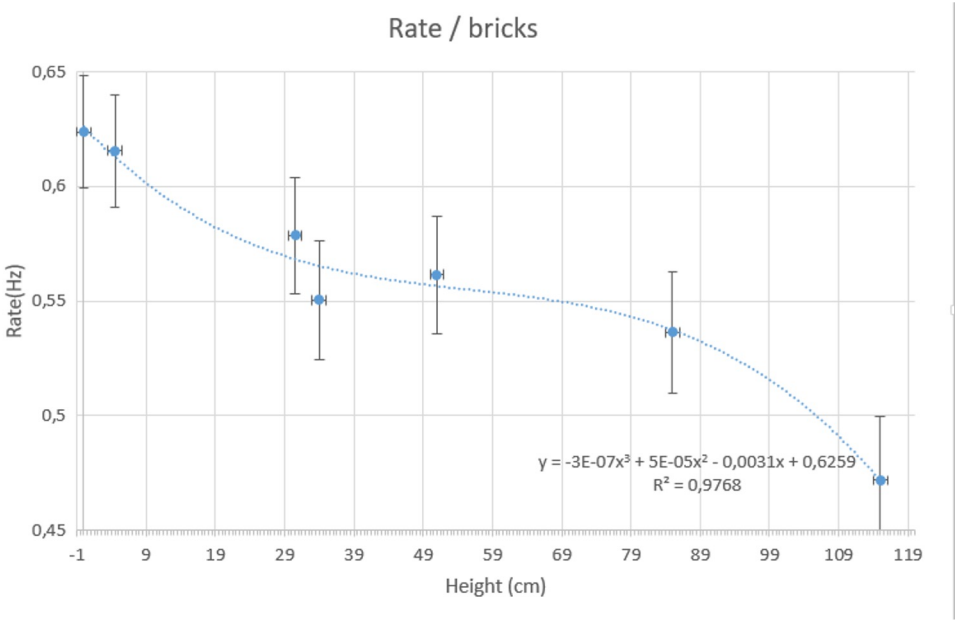
One meter equivalent of water= 31 cm

We observed a peak at 40 cm.

As can be seen from the curve, the Rossi's graph is verified. But **differently** from what was expected the peak happens at a high of 40 cm and not 31 cm. **That's due to the way the experiment was performed.**

ANALYSIS -12/03/2022

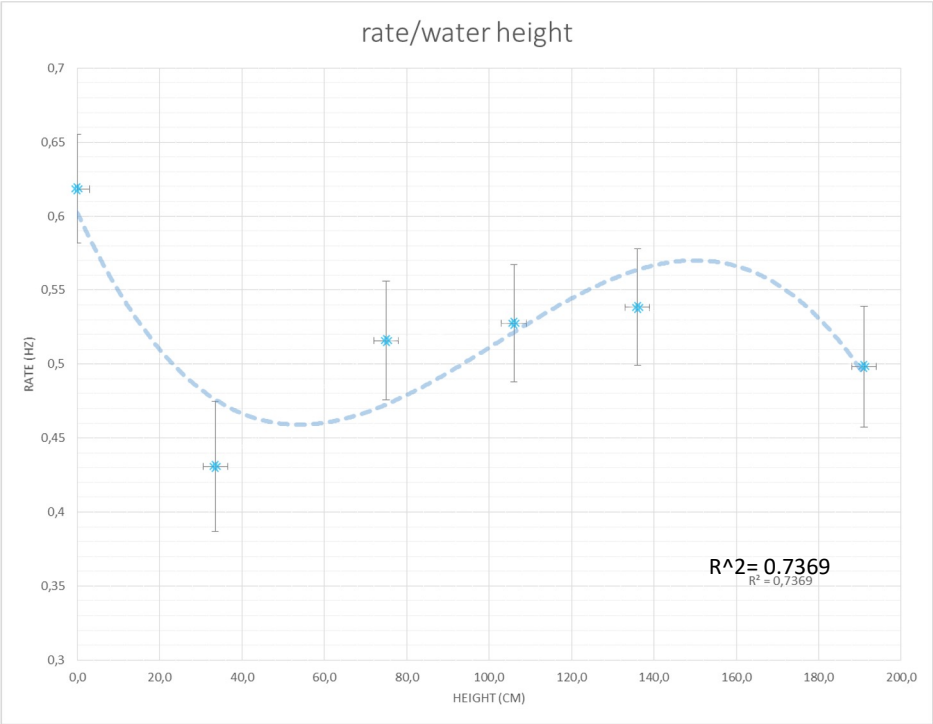
Time	Height	Rate	Count	Error
2700	0	0,623	1684	0,024
2700	4,5	0,061	1662	0,024
2700	30,5	0,578	1562	0,025
2700	34	0,550	1486	0,025
2700	51	0,561	1516	0,025
2700	85	0,536	1448	0,026
2700	115	0,471	1274	0,028



One meter equivalent of water = 50 cm
We observed a peak at 49 centimeters.

Time (s)	Height (cm)	Rate (Hz)	Count	Error
1200	0	0,618	742	0,037
1200	33.5	0,430	517	0,044
1200	75	0,516	619	0,040
1200	106	0,527	633	0,039
1200	136	0,538	646	0,039
1200	191	0,498	598	0,040

ANALYSIS 11/03/2023

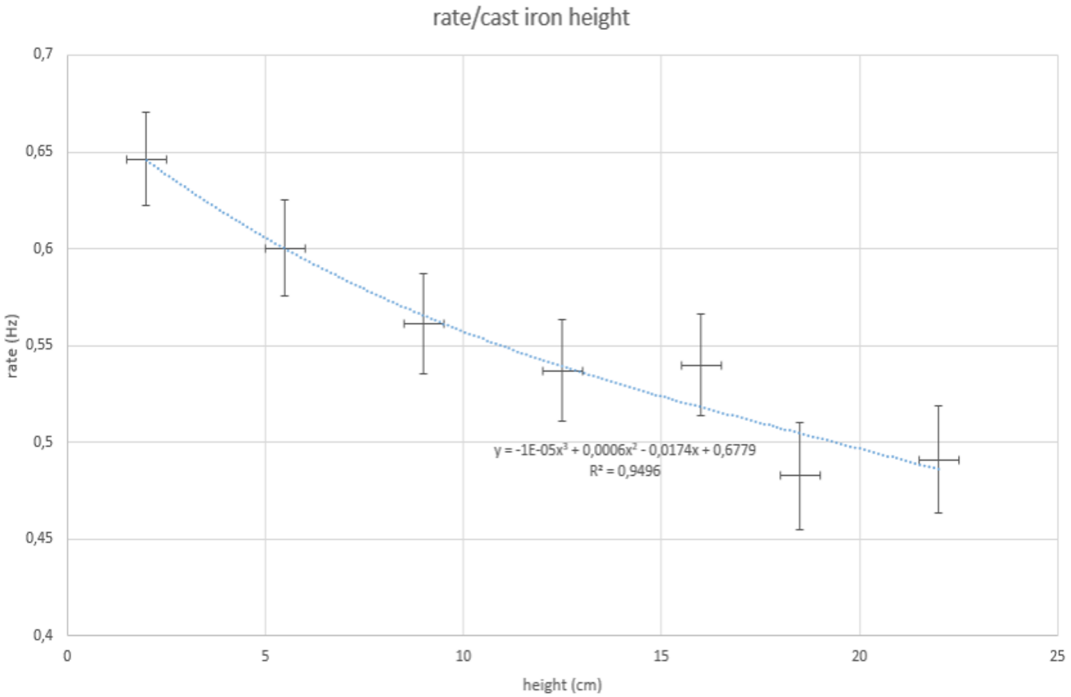


As can be seen from the graph, the Rossi's curve is verified. But, differently from what is expected, the peak happens at a height of 136 cm and not 100 cm. That's due to the manner in which they were taken.

The scaffolds that helds the cistern, the cistern itself and other structures above the Cosmic box have possibly altered the findings

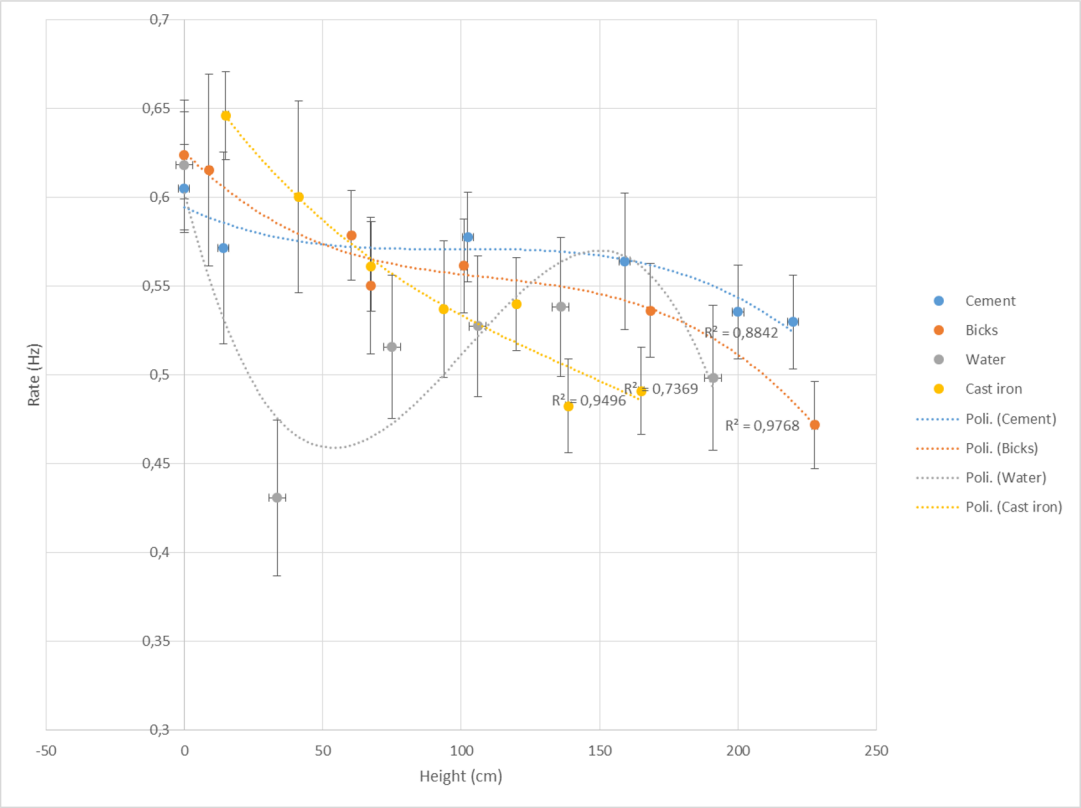
ANALYSIS -07/03/2023

Time (s)	Height (cm)	Rate (Hz)	Count	Error
2700	2	0,646	1745	0,023
2700	5,5	0,600	1621	0,024
2700	9	0,561	1515	0,026
2700	12,5	0,537	1450	0,026
2700	16	0,540	1458	0,026
2700	18,5	0,482	1303	0,027
2700	22	0,491	1326	0,027



One meter equivalent of water=14 cm
We observed a peak at 16 centimeters.

FINAL ANALYZES



Data have been transformed to equivalent of meter of water and then have been put together to verify the Rossi's Curve

This is the final result of all the datas from the experiments.